

REMARKS

I. Status of the Application

Claims 27-45 are pending in the application. Claims 27-33 and 36-43 remain rejected under 35 U.S.C. § 102(e) as anticipated by Leitao, U.S. Patent No. 6,069,295. Claims 34, 35, 44 and 45 remain rejected under 35 U.S.C. § 103(a) as unpatentable over Leitao. Claims 27, 28 and 32-36 remain rejected under 35 U.S.C. § 103(a) as unpatentable over Li, U.S. Patent No. 6,139,585.

Applicants have amended the claims to more clearly define and distinctly characterize Applicants' novel invention. Support for the claim amendments can be found in the specification and the claims as originally filed. Specifically, support for the amendments to claim 27 and 39 to recite a coating including an amorphous layer contacting the implant can be found in the specification at least at page 15, lines 3-15, where Applicants teach the formation of a thin, carbonated calcium phosphate layer, and in Example 1, especially at page 20, lines 12-18 where Applicants teach the formation of an amorphous calcium phosphate layer. Support for the amendments to claim 27 and 39 to recite a crystalline layer contacting the amorphous layer, wherein the crystalline layer comprises calcium and phosphate ions, can be found in the specification at least at page 15, lines 15-24, where Applicants teach the formation of crystalline calcium phosphate layers on the thin calcium phosphate layer (i.e., the amorphous layer), and at page 15, lines 24-27, where Applicants teach that the crystalline layer contains calcium and phosphate. Claims 36 and 37 were amended to depend from claim 27, and to remove limitations recited in claim 27 as amended. The amendments presented herein add no new matter.

Applicants respectfully request entry and consideration of the foregoing remarks, which are intended to place this case in condition for allowance.

II. The Pending Claims are Novel and Nonobvious over the Cited Art

At page 2, paragraph 2 of the instant Office Action, claims 27-33 and 36-43 remain rejected under 35 U.S.C. § 102(e) as being anticipated by Leitao, US. Patent No. 6,069,295. At page 4, paragraph 4 of the instant Office Action, claims 34, 35, 44, and 45 remain rejected under 35 U.S.C. § 103(a) as being unpatentable over Leitao. At page 4, paragraph 5 of the instant Office Action, claims 27, 28 and 32-36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Li, U.S. Patent No. 6,139,585.

The Examiner asserts that the bond strength of Leitao is inherently within the range claimed by Applicants. The Examiner is of the opinion that Leitao teaches a coated implant with a coating, wherein the coating comprises a deposit of octacalcium phosphate crystals nucleated directly on the implant from solution wherein said coating comprises magnesium, calcium and phosphate ions and induces formation of bone cells. The Examiner concludes that because the same chemicals are nucleated onto the same pretreated surface materials, the bond strength between the implants and the coatings of Leitao and Applicants will be the same. The Examiner further asserts that Li teaches a bond strength of greater than 30 MPa and so would include the claimed bond strength. Applicants respectfully traverse these rejections.

Leitao and Li, alone or in combination, fail to teach each and every element of Applicants' amended claims. Applicants' claims are directed to a coated implant comprising *two kinds of layers*: an *amorphous layer* contacting the implant which comprises magnesium ions, calcium ions, and phosphate ions or octacalcium phosphate crystals; and a *crystalline layer* contacting the amorphous layer which comprises calcium and phosphate ions. The amorphous layer is a thin layer that can induce the precipitation of subsequent crystalline layers (specification, page 15, lines 6 and 15-17). The amorphous layer serves as seed crystals for the crystalline layer, and allows the formation of a

thick, uniform crystalline layer (specification, page 15, lines 17-24). Applicants' combination of layers creates a unique coating that strongly adheres to the implant (having a bond strength of between 40 and 65 Mpa) and provides beneficial osteoinductive characteristics to the claimed implant (specification, page 18, lines 22-25).

In contrast to Applicants' coated implants, neither reference cited by the Examiner teaches coated implants wherein the coating comprises two kinds of layers. Leitao teaches an implant having an amorphous apatite-like layer (column 5, lines 48-54). Leitao neither teaches nor suggests a coated implant having a crystalline layer contacting the amorphous layer, as claimed by Applicants. Similarly, Li teaches an amorphous calcium phosphate coating (column 3, lines 40-43), and fails to teach or suggest a coated implant having a crystalline layer contacting the amorphous layer, as claimed by Applicants. Thus the references fail to teach each and every element of Applicants' claimed invention, and accordingly, fail to render Applicants' claimed invention obvious.

In addition to failing to teach Applicants' claimed layers, the coatings of Leitao and Li would not necessarily have the same bond strength as Applicants' claimed coatings. Applicants' respectfully submit that the bond strength by which a coating is attached to an implant is a function of more than the composition of the coating. Applicants' claimed coating is created by a method wherein a solution of ions is kept highly concentrated in the presence of carbon dioxide gas. The rate at which the carbon dioxide is exchanged with air is regulated in order to modulate an increase in the pH of the solution, resulting in the gradual formation of a thin layer comprising submicrometer nuclei on an implant. The inhibition of crystal growth in the amorphous layer plays an important role in achieving a coated implant having Applicants' claimed binding strength. A second layer of crystals is then added using a solution that is not highly concentrated, resulting in a highly

crystallized coating forming on the first layer. In the absence of the first layer, the second layer would be non-uniform and poorly attached to the implant.

In contrast to Applicants' claimed coated implants, the coated implants of Leitao and Li are created by immersing an implant into a solution comprising calcium and phosphate ions. The simple immersion technique, which does not involve a change in pH, results in the formation of an implant having an amorphous (e.g., poorly crystalline) apatite coating (Leitao, column 2, lines 20-22 and column 5, lines 54-55; Li, column 3, lines 39-42). This coating is expected to have a lower binding strength than Applicants' claimed coating. Therefore, in addition to not teaching Applicants' claimed layers, another difference between the coated implants of Leitao and Li and Applicants' claimed coated implants is in the binding strength of the coating.

A third physical difference is that the implants of Leitao and Li would fail to produce formation of bone cells from progenitor cells, as claimed by Applicants, due in part to the solubility of their amorphous layer. It is well known in the art that an amorphous apatite coating is very soluble and that the dissolution of such a coating is in the order of a few days, but that the bone healing process takes at least two to six weeks. Thus, the implants of Leitao and Li would not be available in the relevant time frame to induce the formation of bone cells from progenitor cells. In contrast, Applicants' coated implants having the second crystalline layer promote bone ingrowth and de novo bone formation (specification, page 23, lines 3-4 and lines 30-35).

Thus, Applicants' claimed implants differ significantly from the implants of Leitao and Li. Furthermore, both Leitao and Li fail to teach or suggest all of Applicants' claim limitations. Accordingly, Applicants respectfully request that the rejections of the pending claims be reconsidered and withdrawn.

III. CONCLUSION

Reconsideration and allowance of all the pending claims is respectfully requested. If a telephone conversation with Applicants' attorney would expedite prosecution of the above-identified application, the Examiner is urged to call the undersigned at (617) 720-9600.

Respectfully submitted,

Dated: November 5, 2003



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